CLAIMS

What is claimed is:

CLAIM 1. A system for communication with a downhole tool comprising:

a first communication transceiver in a first tool for measurement while drilling and a second communication transceiver in at least one of said first tool, a second tool for measurement while drilling, and an external instrumentation interface;

a bus system comprising a first conductive connection and a second conductive connection in each of said first tool and said at least one of said first tool, a second tool and an external instrumentation interface, said first conductive connection and said second conductive connection of said first tool in operable communication with said first communication transceiver and said first conductive connection and said second conductive connection of said at least one of said first tool, a second tool and an external instrumentation interface also in operable communication with said second communication transceiver;

wherein said first communication transceiver and said second communication transceiver employ at least one of Quadrature Amplitude Modulation (QAM) and Discrete Multi-Tone (DMT) modulation; and

wherein said bus system carries a combined communications signal including least one of a modulated communication signal, a power signal, and an existing communications signal.

CLAIM 2. The system of Claim 1 wherein each said first conductive connection includes a conductive ring at a drill collar joint and each said second conductive connection includes a pipe.

CLAIM 3. The system of Claim 1 wherein said transmitting and receiving is across a drill collar mating contact between adjacent tools downhole for measurement while drilling.

CLAIM 4. The system of claim 1 wherein said first conductive connection includes a conductive drill collar contact ring.

CLAIM 5. The system of claim 1 wherein said second conductive contact includes a mating of a pipe of said first tool and a pipe of said second tool.

CLAIM 6. The system of claim 1 wherein said operable communication includes a single wire for a combined power and communication signal and a pipe for a return.

CLAIM 7. The system of claim 1 further including a power source in operable communications with said bus system and said transceiver respectively.

CLAIM 8. The system of claim 1 further including a node in operable communications with said bus system and said transceiver respectively.

CLAIM 9. The system of claim 7 wherein said operable communications with said transceiver includes Ethernet.

CLAIM 10. The system of claim 1 further including a first filter interposed between said bus system and said first communication transceiver and in operable communication therewith respectively.

CLAIM 11. The system of claim 10 wherein said first filter comprises at least one of a high pass filter and a band pass filter configured to decompose said combined communication signal to yield a first communication signal.

CLAIM 12. The system of claim 1 further including a first low pass filter interposed between said bus system and a power source and in operable communication therewith respectively, wherein said low pass filter is configured to

decompose said combined communication signal to yield a power signal and an existing communication signal.

CLAIM 13. The system of claim 1 further including a second low pass filter interposed between said bus system and said communication transceiver and in operable communication therewith respectively, wherein said second low pass filter is configured to isolate a power source and a node from a communications signal.

CLAIM 14. The system of claim 1 wherein said first communication transceiver and said second communications transceiver are Very high speed Digital Subscriber Line (VDSL) modems employing quadrature amplitude modulation.

CLAIM 15. The system of claim 1 wherein said first communication transceiver and said second communications transceiver are discrete multitone transceivers employing Orthogonal Frequency Division Multiplexing (OFDM).

CLAIM 16. The system of claim 15 wherein said first communication transceiver and said second communications transceiver employs at least one of 128 and 256 subchannels in a baseband.

CLAIM 17. The system of claim 15 wherein said first communication transceiver and said second communications transceiver employs subchannels modulated using at least one of phase shift keying (PSK) and quadrature amplitude modulation (QAM).

CLAIM 18. The system of claim 1 wherein said first communication transceiver and said second communications transceiver employ a selected communications mode.

CLAIM 19. The system of claim 18 wherein said first communication transceiver and said second communications transceiver employ at least one of a master-slave and a multi-master communications mode each employing at least one of half-duplex operation with Time Division Multiple Access (TDMA) and full duplex operation employing Frequency Division Multiple Access (FDMA) with at least one of fixed and dynamic allocation of operating frequency ranges.

CLAIM 20. The system of claim 1 wherein said first communication transceiver and said second communications transceiver employs forward error correction (FEC).

CLAIM 21. The system of claim 20 wherein said forward error correction (FEC) includes at least one of rate one half convolutional encoding and rate three quarters convolutional encoding.

CLAIM 22. The system of claim 1 wherein said first communication transceiver and said second communications transceiver employs data packets.

CLAIM 23. The system of claim 22 wherein said data packets include at least one of a preamble for synchronization, a header containing a source address for a selected node of a selected tool, a destination address for another node of a particular tool, and a checksum block for error detection.

CLAIM 24. The system of claim 1 wherein said first communication transceiver and said second communications transceiver employs at least one of carrier sense multiple access / collision detection (CSMA / CD) and carrier sense multiple access / collision avoidance (CSMA / CA).

CLAIM 25. The system of claim 1 wherein said first communication transceiver and said second communications transceiver adapt their transmission mode to

conditions of said bus system by selecting at least one of modulation type, forward error correction, (FEC) and frequency ranges employed.

CLAIM 26. A method for communication with a downhole tool comprising:

formulating a combined communications signal;

transmitting and receiving a communication signal with a first communication transceiver in a first tool for measurement while drilling and a second communication transceiver in at least one of said first tool, a second tool for measurement while drilling, and an external instrumentation interface;

utilizing a bus system comprising a first conductive connection and a second conductive connection in each of said first tool and said at least one of said first tool, a second tool and an external instrumentation interface, said first conductive connection and said second conductive connection of said first tool in operable communication with said first communication transceiver and said first conductive connection and said second conductive connection of said at least one of said first tool, a second tool and an external instrumentation interface also in operable communication with said second communication transceiver;

wherein said first communication transceiver and said second communication transceiver employ at least one of Quadrature Amplitude Modulation (QAM) and Discrete Multi-Tone (DMT) modulation; and

wherein said combined communication signal includes at least one of a modulated communications signal, a power signal, and an existing communications signal.

CLAIM 27. The method of Claim 26 wherein each said first conductive connection includes a conductive ring at a drill collar joint and each said second conductive connection includes a pipe.

CLAIM 28. The method of Claim 26 wherein said transmitting and receiving is across a drill collar mating contact between adjacent tools downhole for measurement while drilling.

CLAIM 29. The method of claim 26 further including generating a power signal with a power source in operable communications with said bus system and said transceiver respectively.

CLAIM 30. The method of claim 26 further including communicating with a node in a selected tool.

CLAIM 31. The method of claim 26 further including decomposing said combined communication signal to yield a first communication signal with a first filter.

CLAIM 32. The method of claim 29 wherein said first filter comprises at least one of a high pass filter and a band pass filter interposed between said bus system and said first communication transceiver and in operable communication therewith respectively.

CLAIM 33. The method of claim 26 further including decomposing said combined communication signal to yield a power signal and an existing communication signal.

CLAIM 34. The method of claim 33 wherein said decomposing includes interposing a low pass filter between said bus system and a power source and in operable communication therewith respectively.

CLAIM 35. The method of claim 26 further including isolating a power source and a node from a communications signal with a second low pass filter interposed between said bus system and said communication transceiver and in operable communication therewith respectively.

CLAIM 36. The method of claim 35 wherein said isolating includes interposing a low pass filter between said bus system and a power source and in operable communication therewith respectively.

CLAIM 37. The method of claim 26 wherein said transmitting and receiving includes employing Orthogonal Frequency Division Multiplexing (OFDM).

CLAIM 38. The method of claim 37 wherein said transmitting and receiving employs at least one of 128 and 256 subchannels in a baseband.

CLAIM 39. The method of claim 37 wherein said transmitting and receiving includes modulating subchannels employing at least one of phase shift keying (PSK) and quadrature amplitude modulation (QAM).

CLAIM 40. The method of claim 26 wherein said transmitting and receiving employs a selected communications mode.

CLAIM 41. The method of claim 40 wherein transmitting and receiving employs at least one of a master-slave and a multi-master communications mode each employing at least one of half-duplex operation with Time Division Multiple Access (TDMA) and full duplex operation with at least one of Frequency Division Multiple Access (FDMA) with at least one of fixed and dynamic allocation of operating frequency ranges.

CLAIM 42. The method of claim 26 wherein said transmitting and receiving includes forward error correction (FEC).

CLAIM 43. The method of claim 42 wherein said forward error correction (FEC) includes at least one of rate one half convolutional encoding and rate three quarters convolutional encoding.

CLAIM 44. The method of claim 26 wherein said transmitting and receiving employs data packets.

CLAIM 45. The method of claim 44 wherein said data packets include at least one of a preamble for synchronization, a header containing a source address for a selected node of a selected tool, a destination address for another node of a particular tool, and a checksum block for error detection.

CLAIM 46. The method of claim 26 wherein said transmitting and receiving includes at least one of carrier sense multiple access / collision detection (CSMA / CD) and carrier sense multiple access / collision avoidance (CSMA / CA).

CLAIM 47. The method of claim 26 wherein said first communication transceiver and said second communications transceiver adapt their transmission mode to conditions of said bus system by selecting at least one of modulation type, forward error correction, (FEC) and frequency ranges employed.

CLAIM 48. A storage medium encoded with a machine-readable computer program code, said code including instructions for causing a computer to implement a method for communication with a downhole tool, the method comprising:

formulating a combined communications signal;

transmitting and receiving a communication signal with a first communication transceiver in a first tool for measurement while drilling and a second communication transceiver in at least one of said first tool, a second tool for measurement while drilling, and an external instrumentation interface;

utilizing a bus system comprising a first conductive connection and a second conductive connection in each of said first tool and said at least one of said first tool, a second tool and an external instrumentation interface, said first conductive connection and said second conductive connection of said first tool in operable communication with said first communication transceiver and said first conductive connection and said second conductive connection of said at least one of said first tool, a second tool and an external instrumentation interface also in operable communication with said second communication transceiver;

wherein said first communication transceiver and said second communication transceiver employ at least one of Quadrature Amplitude Modulation (QAM) and Discrete Multi-Tone (DMT) modulation; and

wherein said combined communication signal includes at least one of a modulated communications signal, a power signal, and an existing communications signal.

CLAIM 49. A computer data signal: said computer data signal comprising code configured to cause a processor to implement a method for communication with a downhole tool, the method comprising:

formulating a combined communications signal;

transmitting and receiving a communication signal with a first communication transceiver in a first tool for measurement while drilling and a second communication

transceiver in at least one of said first tool, a second tool for measurement while drilling, and an external instrumentation interface;

utilizing a bus system comprising a first conductive connection and a second conductive connection in each of said first tool and said at least one of said first tool, a second tool and an external instrumentation interface, said first conductive connection and said second conductive connection of said first tool in operable communication with said first communication transceiver and said first conductive connection and said second conductive connection of said at least one of said first tool, a second tool and an external instrumentation interface also in operable communication with said second communication transceiver;

wherein said first communication transceiver and said second communication transceiver employ at least one of Quadrature Amplitude Modulation (QAM) and Discrete Multi-Tone (DMT) modulation; and

wherein said combined communication signal includes at least one of a modulated communications signal, a power signal, and an existing communications signal.

CLAIM 50. A system for communication with a downhole tool comprising:

a means for formulating a combined communications signal;

a means for transmitting and receiving a communication signal with a first communication transceiver in a first tool for measurement while drilling and a second communication transceiver in at least one of said first tool, a second tool for measurement while drilling, and an external instrumentation interface;

a means for utilizing a bus system comprising a first conductive connection and a second conductive connection in each of said first tool and said at least one of said first tool, a second tool and an external instrumentation interface, said first conductive connection and said second conductive connection of said first tool in operable communication with said first communication transceiver and said first conductive connection and said second conductive connection of said at least one of

said first tool, a second tool and an external instrumentation interface also in operable communication with said second communication transceiver;

wherein said first communication transceiver and said second communication transceiver employ at least one of Quadrature Amplitude Modulation (QAM) and Discrete Multi-Tone (DMT) modulation; and

wherein said combined communication signal includes at least one of a modulated communications signal, a power signal, and an existing communications signal.